CLAIMS

1. A power tool adapted to tighten a fastener, comprising:

a motor,

means for generating an elevated torque, wherein the elevated torque generating means is coupled to the motor and has output shaft, wherein if a load acting on the output shaft is less than a predetermined value, rotating torque generated by the motor is directly transmitted to the output shaft and if a load acting on the output shaft exceeds the predetermined value, an elevated torque is generated by the elevated torque generating means and applied to the output shaft,

a load shaft connected to the output shaft,

means for detecting change in rotational angle of either the output shaft or the load shaft and the direction of rotation thereof,

a memory for storing a state of either output shaft or the load shaft detected by the detecting means, and

a processor in communication with the motor, the detecting means and the memory, the detecting means communicating signals corresponding to the state of either the output shaft or the load shaft to the processor, wherein the processor stores the state of either the output shaft or the load shaft in the memory at predetermined interval, and wherein the processor determines a generating time, at which the means for generating an elevated torque generates the elevated torque, based upon the state of either the output shaft or the load shaft.

2. A power tool as in claim 1, wherein the means for generating an elevated torque comprises:

an anvil, and

a hammer coupled to the motor, the hammer being adapted to strike the anvil to thereby rotate the anvil and generate the elevated torque.

3. A power tool as in claim 1, wherein the means for generating an elevated torque

comprises an oil pulse unit.

4. A power tool as in claim 1, wherein the detecting means comprises:

a plurality of magnets disposed around an outer surface of either the output shaft or the load shaft so that the magnets integrally rotate with the output shaft or the load shaft, each magnet having a South pole and a North pole, wherein the South poles are disposed in an alternating relationship with the North poles,

a first sensor fixedly disposed relative to the magnets, such that the first sensor will not rotate when the output shaft or load shaft rotates, wherein the first sensor latches its output signal to a first level when detecting a North pole magnetic field, and latches its output signal to a second level when detecting a South pole magnetic field, and

a second sensor fixedly disposed relative to the magnets, such that the second sensor will not rotate when the output shaft or load shaft rotates, wherein the second sensor latches its output signal to the first level when detecting the North pole magnetic field, and latches its output signal to the second level when detecting the South pole magnetic field, wherein the output signal of the first sensor and the output signal of the second sensor are shifted by first phase when the output shaft or load shaft rotates in a direction of tightening a fastener, and are shifted by second phase when the output shaft or load shaft rotates in a direction of loosening the fastener.

5. A power tool as in claim 1, wherein the detecting means comprises an encoder.

6. A power tool as in claim 1, wherein the processor further (1) calculates the changes in the rotational angle of either the output shaft or the load shaft in the tightening direction from the determined generating time until a predetermined period has elapsed, and (2) determines whether the fastener has reached a seated position against the workpiece based upon the calculated changes in the rotational angle.

7. A power tool as in claim 6, wherein the processor stops the motor when a predetermined time has elapsed after determining that the fastener has reached the seated

position against the workpiece.

8. A power tool as in claim 6, wherein the processor stops the motor after a first predetermined time has elapsed from a time when the processor has determined, for a predetermined number of times, that the fastener has reached the seated position against the workpiece.

9. A power tool as in claim 8, wherein the processor does not determine that the fastener has reached the seated position against the workpiece during a second predetremined time elapsing from a time when the processor determined the fastener to reach the seated position against the workpiece.

10. A power tool as in claim 6, wherein the processor stops the motor after the means for generating an elevated torque has generated the elevated torque for a predetermined number of times from a time when the processor determined the fastener to reach the seated position against the workpiece.

11. A power tool as in claim 1, wherein (1) at the time when change in the rotational angle of either the output shaft or the load shaft has occurred, the processor calculates the changes in the rotational angle of the output shaft or the load shaft in the tightening direction during a first predetermined period extending from a time prior to the change in the rotational angle until the change in the rotational angle occurs, (2) when the calculated changes in the rotational angle is within a first predetermined value, the processor further calculates the absolute value of the changes in the rotational angle of either the output shaft or the load shaft in a period lasting from the change in the rotational angle until a second predetermined period has elapsed , and (3) when the absolute value of the changes in the rotational angle is greater than a second predetermined value, the processor determines that the time of occurrence of the change in the rotational angle is the generating time.

12. A power tool as in claim 11, wherein the processor further (1) calculates the changes

in the rotational angle of either the output shaft or the load shaft in the tightening direction from the determined generating time until a third predetermined period has elapsed, and (2) determines that the fastener has reached a seated position against the workpiece when the calculated changes during the third predetermined period is within the third predetermined value.

13. A power tool adapted to tighten a fastener, comprising:

a motor,

means for generating an elevated torque, wherein the elevated torque generating means is coupled to the motor and has output shaft, wherein if a load acting on the output shaft is less than a predetermined value, rotating torque generated by the motor is directly transmitted to the output shaft and if a load acting on the output shaft exceeds the predetermined value, an elevated torque is generated by the elevated torque generating means and applied to the output shaft,

a load shaft connected to the output shaft,

means for detecting change in rotational angle of either the output shaft or the load shaft and the direction of rotation thereof,

a memory storing automatic stopping programs for automatically stopping the motor for each of differing types of workpiece, and

a processor in communication with the motor, the detecting means and the memory, the detecting means communicating signals corresponding to the state of either the output shaft or the load shaft to the processor, wherein the processor (1) determining the type of workpiece based upon the signals from the detecting means, and (2) selecting the automatic stopping program based upon the determined type of workpiece, and (3) stopping the motor in accordance with the selected automatic stopping program.

14. A power tool as in claim 13, wherein the processor (1) calculates a cumulative rotational angle of either the output shaft or the load shaft in the tightening direction within a predetermined period after the fastener has reached the seated position against the workpiece, and (2) determines the type of workpiece based upon the calculated cumulative

rotational angle.

15. A power tool as in claim 13, wherein the processor (1) calculates average changes in rotational angle of either the output shaft or the load shaft in the tightening direction per one elevated torque after the fastener has reached the seated position against the workpiece, and (2) determines the type of workpiece based upon the calculated average changes.